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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/039,309	11/07/2001	Eiji Sato	45672/56,682	2127

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EXAMINER	
MONDT, JOHANNES P	
ART UNIT	**PAPER NUMBER**
3663	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	04/06/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/039,309	SATO ET AL.	
	Examiner	Art Unit	
	Johannes P. Mondt	3663	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 January 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 and 4-9* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 and 4-9* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *03 January 2007* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

Amendment filed 1/3/07 forms the basis for this office action. In said Amendment Applicant filed a "New Sheet" in response to a Drawing Objection in the previous office action and an amendment to the Specification in response to an objection to the Specification in the previous office action. Applicant substantially amended claims 1 and 4-9, rejected in the previous office action, at least through substantial amendment of independent claim 1. Comments on Remarks submitted with said Amendment are included below under "Response to Arguments".

Drawings

The drawings of Replacement Sheet for Figure 12B and New Sheet for Figures 13A and 13B were received on 1/3/07. These drawings are approved.

Specification

The Amendment to the Specification filed 1/3/07 has been approved. The objection to the Specification made in section 1 under "Specification" in the previous office action has been withdrawn.

The objection to the Specification made in section 2 under "Specification" is withdrawn in light of the amendment to the claims.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

1. ***Claims 1, 4-6, and 8*** are rejected under 35 U.S.C. 102(b) as being anticipated by van den Berk (4,536,059) (previously cited).

Van den Berk teaches a liquid crystal display device, comprising: a liquid crystal layer between two glass supporting plates 1 and 2; see col. 4, l. 25-37)); a pair of substrates 1 and 2 (loc.cit.) so as to interpose the liquid crystal layer therebetween (see Figure 3); and a plurality of pixels arranged in matrix pattern (col. 4, l. 10-12) wherein: the liquid crystal layer has a helical structure (col. 3, l. 65) and exhibits at least two stable states including a planar state (col. 3, l. 53-58) and a focal conic state (col. 3, l. 61-65) according to an applied voltage (loc.cit.); and in each of the plurality of pixels, a thickness d of the liquid crystal layer has at least two different values (see Figure 3), and the liquid crystal layer includes at least two regions having different values for a first threshold voltage for transitioning the liquid crystal layer from the planar state to the focal conic state (because the electrodes 5 are provided in the grooves and extend over "second ridges" 4 onto "first ridges" 3, hence extend over regions of different thickness d (see Figure 3 and col. 3, l. 1-19) while said electrodes form an equipotential surface bordering the liquid crystal layer, and consequently the electric field at two positions of different thickness is different),

Wherein the thickness d of the liquid crystal layer satisfies a relationship of $1 < d/P < 15$ with a helical pitch P of the helical structure as evidenced by Figure 1b, showing d=2 P in at least one embodiment, and wherein the thickness d of the liquid crystal layer is

defined so that VthFmax is less than VthHmin in each of the plurality of pixels, where VthFmax denotes the first threshold voltage for transitioning the liquid crystal layer included in a region with a largest thickness d of the liquid crystal layer from the planar state to the focal conic state, and VthHmin denotes a threshold voltage for transitioning the liquid crystal layer included in a region with a smallest thickness d of the liquid crystal layer from the focal conic state to a homeotropic state, because "Upon applying a voltage across the transparent electrodes" as described in col. 3, l. 61-65, "planar-conic texture changes into a focal-conic texture", while ONLY when the field strength increases above a given value E2 the helices uncoil and a transparent homeotropic-nematic texture is formed" (col. 3, l. 65-68), where $E_1<E_2$ (see col. 4, l. 1-5).

With regard to the limitation "whereby the liquid crystal display device is capable of performing an intermediate gray level display or a multiple gray level display", intended use and other types of functional language must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In re Casey,152 USPQ 235 (CCPA 1967); In re Otto , 136 USPQ 458, 459 (CCPA 1963). In the underlying case there is no reason why a voltage across the liquid crystal layer could not be selected such that the electric field is below the planar-to-focal-conic transition threshold in one sector of the liquid crystal layer and above said transition threshold, because for a given voltage the electric field in the liquid crystal layer is inversely proportional to the thickness of said liquid crystal layer: the very existence of a finite difference in threshold

voltage as a function of thickness is thus seen to make the liquid crystal device as claimed capable of performing the intended use.

On claim 4: a value of the thickness d of the liquid crystal layer increases from the center of the liquid crystal display (boss 10) to each end of the liquid crystal display device (Figure 3) and said increase in thickness is effected by a succession of a plurality of substantially flat or horizontal regions in a pixel electrode that provides a staircase pattern that rises (although not monotonically) from each of said ends to said center of the liquid crystal display device.

On claim 5: a difference Δd between the at least two different values of thickness d of the liquid crystal layer satisfies a relationship of $0.5\ P \leq \Delta d$ with the helical pitch P of the helical structure, namely: while Fig. 1b shows that d/P = 2 van den Berk teaches that the thickness at the area of the edges is only half the maximum thickness (col. 5, l. 19-21), i.e., $\Delta d = d/2$, resulting in the teaching $\Delta d \geq P > 0.5\ P$, i.e., $0.5\ P \leq \Delta d$.

On claim 6: a value of the thickness d of the liquid crystal layer changes continuously across each of the plurality of pixels because a continuous line can be drawn across said pixels (see Figure 3) (see Figure 3).

On claim 8: at least one of the pair of substrates 1 and 2, namely: 1, includes a concave or convex surface (depending on one's center of reference being either below or above layer 1) that is closer to the liquid crystal layer than the other side.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at.the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. ***Claim 7*** is rejected under 35 U.S.C. 103(a) as being unpatentable over van den Berk as applied to claim 1, in view of Scherer (5,880,801) (first cited previously in office action mailed 4/2/704).

Van den Berk teaches a pair of alignment layers provided respectively on the pair of substrates on one side thereof closer to the liquid crystal (col. 5, l. 57-61). Van den Berk does not necessarily disclose one of said pair to be a horizontal alignment layer and the other one to be a vertical alignment layer.

However, it would have been obvious to include said further limitation in view of Scherer et al, who teach top and bottom substrates 42 and 44, respectively (cf. col. 4, l. 20-60) to be aligned horizontally and vertically, respectively, so as to achieve hybrid-aligned cells by which an electro-optic response is achieved at low voltage compared with a device with pure homogeneous alignment (cf. col. 3, l. 29-47).

Motivation to include the teaching by Scherer into the invention by van den Berkin this regard stems from the desirability to achieve response at low voltage (Scherer, loc.cit), which is a ubiquitous advantage in the electrical art. Combination of said teaching and said invention is straightforward through the process to make HAN crystal cells as disclosed by Scherer et al (cf. col. 3, l. 7-47). Success in implementing said combination can therefore be reasonably expected.

3. ***Claims 1, 8 and 9*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada et al (5,831,704) in view of Nakamura et al (5,576,860) (previously cited).

Yamada et al teach a liquid crystal device (title, abstract, "Background of the Invention"), comprising: a liquid crystal layer 3 (col. 9, l. 53-57); a pair of substrates 1/2b (col.10, l. 46 and col. 11, l. 49-63) and 5 (col. 11, l. 9) provided so as to interpose the liquid crystal therebetween (see Figure 5); and a plurality of pixels arranged in a matrix pattern (Figures 1 and 6 and their descriptions), wherein:

the liquid crystal layer has a helical structure (in the sense given by the specification (the liquid crystal molecules in said liquid crystal layer are twistable helically((see col. 1, l. 62 - col. 2, l. 14) and exhibits at least two stable state including a planar state (Figure 3A and col. 9, l. 52-60) and a focal conic state (Figure 3C and col. 9, l. 60-64) according to an applied voltage (lco.cit.); and

in each of the plurality of pixels, a thickness d of the liquid crystal layer has at least two different values (col. 9, l. 52-56), and the liquid crystal layer includes at least two regions having different values of a first threshold voltage for transitioning the liquid crystal layer from the planar state to the focal conic state (inherently so because the transition is determined by electric field value, not voltage value, - see for instance F.M. Leslie, "Introduction to Nematodynamics", Chapter 8 in "Physical Properties of Liquid Crystals: Nematics", Ed.: D. Dunmur et al, Institution of Engineering and Technology 2001, especially pages 393-394 (C3.1); while the electric field due to a voltage across a layer of a any thickness is voltage per thickness; see, e.g., J.D. Jackson, "Classical Electrodynamics", page 8).

wherein the thickness d of the liquid crystal layer satisfies a relationship 1 ≤ d/P (see col. 9, l. 57-60, from which it follows that a vertical alignment of molecules is possible when there is no voltage, and hence the thickness d must at least be equal to the pitch) with a helical pitch P of the helical structure; and

wherein the thickness d of the liquid crystal layer is defined so that VthFmax is less than VthHmin in each of the plurality of pixels, where VthFmax denotes the first threshold voltage for transitioning the liquid crystal layer included in a region with a largest thickness d of the liquid crystal layer from the planar state to the focal conic state (i.e., from state of Figure 3A to state of Figure 3C; loc.cit.), and VthHmin denotes a second threshold voltage for transitioning the liquid crystal layer included in a region with a smallest thickness d of the liquid crystal layer from the focal conic state to a homeotropic state (because "when a saturation voltage is applied the liquid crystal molecules 7 align in a direction substantially parallel to the plate c"; cf. col. 9, l. 60-64; from which it can be concluded that no homeotropic transition has taken place, considering the transition as described, from the planar state through gradual tilt over angle B to the focal conic state; col. 9, l. 52-col. 10, l. 9; the transition for a given thickness and voltage, i.e., for a given electric field (once again, only field values matter in the physics of molecular orientation) from focal conic to homeotropic inherently occurs at a higher threshold field value than the establishment of the focal conic state in the first place: without focal conic state no transition from the focal conic state is possible logically)

whereby the liquid crystal display device is capable of performing an intermediate gray level display or multiple gray level display (col. 9, l. 46-67) (N.B.: "intermediate" is considered a pleonasm, considering the meaning of "gray" in the art

as being of intermediate color between black and white, and hence is considered automatically met by "gray"; "multiple gray" is considered met as well because for each "gray-scale voltage a different gray is achieved because the tilt depends on the electric field which depends inter alia on the voltage, while locally the thickness is fixed).

Yamada et al do not necessarily teach the range limitation that not only is $P \leq d$ (which Yamada et al do teach, see overleaf), but even that d/ P is truly between 1 and 15.

However, it would have been obvious to include said further limitation in view of Nakamura et al, who, in a patent on a liquid crystal display based on a nematic liquid crystal with helical pitch (cf. col. 3, l. 3-23), hence closely related to the liquid crystal device by Yamada et al based on nematic phases, i.e., relating to the orientation of the long axis of liquid crystal molecules (col. 9, l. 52-64), that the ratio of the liquid crystal layer (numeral 7 in Figure 5) thickness d divided by the helical pitch P, for the purpose of achieving high contrast and hence bright display, preferentially is to be in the range $1.5 < d/P < 4$ (cf. col. 3, l. 10-45).

A *prima facie* case of obviousness typically exists when the ranges of a claimed composition overlap the ranges disclosed in the prior art or when the ranges of a claimed composition do not overlap but are close enough such that one skilled in the art would have expected them to have the same properties. In re Peterson, 65 USPQ2d 1379 (CA FC 2003).

Motivation to combine the teaching by Nakamura et al in this regard with the invention at least derives from the statement by Nakamura et al on the accomplishment of achieving a high contrast and thus a bright display (cf. col. 5, l. 1-3), which is a generic advantage for liquid crystal displays.

On claim 8: at least one of the pair of substrate includes a concave or convex surface on one side thereof that is closer to the liquid crystal layer than the other side, namely: either substrate 1/2b or substrate 5 (see Figure 5).

On claim 9: the pair of substrate 1/2b and 5 both include a concave or convex surface on one side thereof that is closer to the liquid crystal layer than the other side thereof.

4. ***Claim 4*** is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada et al and Nakamura et al as applied to claim 1 above, and further in view of Ogawa et al (4,632,514) (previously cited).

As detailed above, claim 1 is unpatentable over Yamada et al in view of Nakamura et al.

Although neither Yamada et al nor Nakamura et al necessarily teach the further limitation as defined by claim 4, *it would have been obvious to include said further limitation in view of Ogawa et al,* who, in a patent drawn to a multi-color liquid crystal display, hence analogous art to Yamada et al, teach variation of the thickness of the liquid crystal layer such that different abutting substantially flat or horizontal regions in a pixel electrode have different liquid crystal layer thickness for different color picture elements (cf. abstract and col. 3, l. 60-65) thus providing a staircase pattern (cf. abstract

and Figures 15-16). Note that thickness increase is effected by a succession of a plurality of substantially flat or substantially horizontal regions (cf. Figures 15 1-6) and that in Figures 15-16 and 21-22 said thickness increases from the center to each end of the liquid crystal display.

Motivation to include the teaching by Ogawa et al in this regard is the minimization of optical rotatory dispersion thus improving quality of display (cf. abstract).

Response to Arguments

Applicant's arguments filed 1/3/07 have been fully considered but they are not persuasive. In particular, that van den Berk is operated in a different manner, as suggested by the traverse on page 7 with reference to column 4, lines 8-12, is of no patentable significance in the present product invention. Applicant is reminded in this respect that reference to intended use and other types of functional language must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In re Casey,152 USPQ 235 (CCPA 1967); In re Otto , 136 USPQ 458, 459 (CCPA 1963). In the underlying case, the different values for the electric field in different locations of the liquid crystal layer implies the capability of the device for being used such that "at least two regions have different values of a first threshold voltage for transitioning the liquid crystal layer from the planar state to the focal conic state" as recited in claim 1. Once again, given any voltage head across the liquid crystal layer the electric field has different values at different locations. Because the transition from planar to focal conic is

only material-specific and the material of the liquid crystal layer is everywhere the same, it follows that necessarily the voltage threshold for said transition differs between said at least two locations, because the physics criterion is one involving the electric field strength. Applicant's comment that the ridges provided by van den Berk have no effect in providing a LCD device capable of performing a gray level display fails to take into account the electric field line distribution resulting from the electrodes and crossing liquid crystal material. Applicant's comment that "in each of the pluralities of pixels, a thickness d of the liquid crystal layer includes at least two different values of a first threshold voltage for transitioning the liquid crystal layer from the planar state to the focal conic state" is a structural distinction over the prior art, is not true because of the existence of different electric field strengths within the liquid crystal layer also in the prior art (van den Berk), given any voltage across the electrodes. The intended use only comes in when the voltage is selected such as to correspond to a value for the electric field at one location that is below the threshold electric field for the transition from planar to focal conic and to a different value for the electric field at another location that is above said threshold electric field. It is once more stressed that there does not exist a threshold voltage for said transition, only an electric field threshold, the latter being local precisely because of the different path lengths of electric field lines through different portions of the same liquid crystal material.

In light of the above considerations the claims stand rejected as before.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

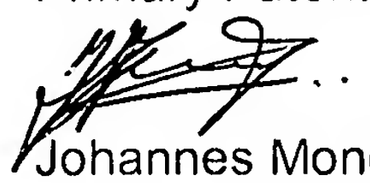
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Johannes P. Mondt whose telephone number is 571-272-1919. The examiner can normally be reached on 8:00 - 18:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jack W. Keith can be reached on 571-272-6878. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JPM
March 30, 2007

Primary Patent Examiner:



Johannes Mondt (Art Unit: 3663)